



U.S. Department
of Transportation

400 Seventh Street, S.W.
Washington, D.C. 20590

**Pipeline and
Hazardous Materials
Safety Administration**

JUN 6 2005

DOT-E 14005
(SECOND REVISION)

EXPIRATION DATE: February 28, 2007

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Scientific Cylinder International, LLC
Castle Rock, CO
2. PURPOSE AND LIMITATION:
 - a. This exemption authorizes the use of certain DOT Specification 3A, 3AA, 3BN cylinders and cylinders manufactured under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692 for the transportation in commerce of the compressed gases described in paragraph 6 below, when retested by a 100% ultrasonic examination in lieu of the internal visual and the hydrostatic retest. This exemption provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein.
 - b. The safety analyses performed in development of this exemption only considered the hazards and risks associated with transportation in commerce.
 - c. Party status will not be granted to this exemption.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 172.203(a) and 172.301(c) in that marking the exemption number is waived; and § 180.205 in that the ultrasonic examination (UE) is performed in lieu of the specified internal visual examination and hydrostatic pressure test.

NOTE: This does not relieve the holder of this exemption from securing and maintaining a valid approval for retesting cylinders from the Associate Administrator for Hazardous Materials Safety.

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5. BASIS: This exemption is based on Scientific Cylinder International's (SCI) application dated May 10, 2005 submitted in accordance with § 107.105 and 107.117 to prevent severe economic loss.

6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Hazardous Materials Description			
Proper Shipping Name	Hazard Class/ Division	Identification Number	Packing Group
Liquefied or non-liquefied compressed gases, or mixtures of such compressed gases, classed as Division 2.1, (flammable gas) Division 2.2, (nonflammable gas) or Division 2.3, (gases which are Toxic by Inhalation (TIH)), which are authorized in the Hazardous Materials Regulations for transportation in DOT 3A, 3AA, 3BN cylinders and those commodities authorized under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692.	2.1, 2.2 or 2.3 as applicable	As Appropriate	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packagings prescribed are DOT Specification 3A, 3AA and 3BN cylinders and cylinders manufactured under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11662 that is subjected to periodic retesting, reinspection and marking prescribed in § 180.209, except that the cylinder is examined by an ultrasonic method in lieu of the hydrostatic pressure test and internal visual inspection. Each cylinder must be subjected to an external visual examination and retested and marked in accordance with the UE procedure described herein and SCI's October 26, 2004 application for exemption on file with the Office of Hazardous Materials Exemptions and Approvals (OHMEA). A cylinder that has been exposed to fire or to excessive heat may not be retested under the terms of this exemption.

b. Equipment and Performance.

Ultrasonic System - The ultrasonic equipment performance must conform to SCI's October 26, 2004 application on file with OHMEA and as prescribed in this exemption. The UE equipment incorporates a single channel immersion system arranged to perform straight and angle beam examinations. The ultrasonic pulses must enter into the cylinder wall in both longitudinal, both circumferential directions and normal to the cylinder wall to ensure 100 percent coverage of the cylinder wall. The system must be set-up to perform longitudinal ultrasonic angle beams from the cylinder shoulder down to the cylinder base that includes sidewall-to-base transition (SBT) area and from the cylinder base up to the cylinder shoulder. Also the system must be set-up to perform circumferential ultrasonic angle beams in both clockwise and counterclockwise rotation around the cylinder. All defects (such as isolated pits, line corrosion, sidewall defects (e.g. cracks, folds) and line corrosion must be detected. The transducer or cylinder must be arranged so that the ultrasonic beams enter into the cylinder wall and measure thickness and detect the side wall flaws. The immersion UE system must have a high speed board to digitize and capture each A-scan during examination of the cylinder. Gain control accuracy must be checked every six months with equipment that is calibrated in accordance with industry standards for checking gain linearity accuracy, as published in ASTM-E317. Search units of 2.25 to 10 MHZ nominal frequency and 1/4" to a 1" diameter must be used during ultrasonic examination. A manual contact shear or longitudinal search unit may be used for confirmation and sizing of an indicated defect. If manual UE is used, it must be performed under direct supervision of a Senior Review Technologist by a minimum Level II operator and in accordance with American Society of Testing Materials (ASTM) practice E 213 and this exemption.

c. Standard References

(1) UE Reference Cylinder - A cylinder or cylinder section must be used as a standard reference and must have similar acoustic properties, surface finish and metallurgical condition as the cylinders under test. The standard reference, (reference cylinder) must have a known minimum design wall thickness (t_m) which is less

than or equal to the cylinder under test. The standard reference cylinder for cylinders less than or equal to 6-inches in diameter must have the same nominal diameter as the cylinder being tested.

Cylinders greater than 6-inches in diameter must conform to the allowable size ranges shown in the following table:

Standard Reference	Cylinder Size Ranges is being retested by UE	
Outside Diameter (OD-inches)	Minimum OD- inches	Maximum OD- Inches
7	6.30	10.50
7.50	6.75	11.25
9.00	8.10	13.50
9.25	8.33	13.88
10.00	9.00	15.00
12.00	10.80	18.00

Prior to placing the simulated defects, such as minimum wall thickness, the average minimum wall thickness for the standard reference must be determined by means of an independent method.

(2) The standard reference (reference cylinder) must be prepared to include the following artificial defects:

(i) Simulated defect for reduction in wall thickness (area corrosion). A simulated defect for area corrosion must be machined into the inside surface of the cylinder. A minimum of two different thickness steps must be machined into the inside cylinder wall. Dimensions must be as follows:

(A) For DOT 3A and 3AA, the simulated defect must be less than or equal to 0.7 square inches (in^2) and less than or equal to $1/20$ of the design minimum wall thickness (t_m) deep. The remaining wall thickness is equal or greater than t_m .

(B) For DOT 3BN, and cylinders manufactured under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692 the simulated defect must be less than or equal to 0.25 square inch (in^2) and less than or equal to $1/20$ of the minimum

design wall thickness (t_m) deep. The remaining wall thickness is equal or greater than t_m .

(ii) Simulated defect for an isolated pit. A flat bottom hole (FBH) must be machined into the inside surface of the cylinder to simulate an isolated pit. Dimensions must be as follows:

(A) For DOT 3A and 3AA with diameter less than or equal to 4 inches the FBH must be 1/8-inch diameter and 1/3 of t_m depth.

(B) For DOT 3A and 3AA with diameter greater than 4 inches the FBH must be 1/4-inch diameter and 1/3 of t_m depth.

(C) For DOT 3BN, and cylinders manufactured under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692 the FBH must be 1/4-inch diameter and 1/4 of t_m depth.

(iii) Simulated defect for line corrosion in the sidewall-to-base transition (SBT). A circumferential notch must be machined into the surface of the cylinder to simulate SBT line corrosion. The notch must be 0.10 of t_m depth, 1 inch long and less than or equal to 0.02 inch with.

(iv) Simulated defect for longitudinal sidewall crack (LSC). A longitudinal notch must be machined into the surface of the cylinder to simulate LSC line corrosion. Dimensions of the LSC notch for DOT 3BN and cylinders manufactured under DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692 must be 0.06 of t_m depth, 1 inch long and less than or equal to 0.02 inches in with. DOT 3A and 3AA specification cylinders are not required to standardized for LSC.

(3) A certification statement signed by a SCI senior review technologist (SRT) must be available for all standard references at each site where retesting is performed. The certification statement must include a standard reference drawing for each size and type of cylinder. A standard reference drawing must include dimensions and the locations of each simulated defect.

d. Ultrasonic Examination (UE) system Standardization (Calibration). Prior to retesting a cylinder, the cylinder class (DOT specification or exemption) must be identified. The UE system must be standardized for testing the identified cylinder by using a standard reference. The standard reference must be similar (material of construction, size, wall thickness, etc.) to the identified cylinders to be tested. Standardization of the UE system must be performed by using a relevant reference cylinder that is described in paragraph 7.c. of this exemption. The standardization of the UE system is as follows:

(1) A reference cylinder with a machined simulated defect made to represent area corrosion must be placed in the UE system. The UE system must be standardized to indicate rejection for an area equal or greater than the machined surface for that class of cylinder (e.g. 0.70 in² for DOT 3A, 3AA and 0.25 in² for 3BN, DOT-E 9421, 9706, 9909, 10047, 9370, 9791, 10869 and 11692). Where the wall thickness is reduced below t_m , a straight ultrasound beam must be used to measure the wall thickness of the machined area.

(2) A reference cylinder with a machined FBH made to represent an isolated pit must be placed in the UE system. The FBH must be detected by a minimum of two shear wave beams that strike the FBH from opposite sides (e.g. the first shear wave direction is from top to bottom of the cylinder and the second shear wave direction is from the bottom to top). The UE gain must be increased until the signal from FBH is maximized at 80 percent of the screen height.

(3) A reference cylinder with a machined notch made to represent SBT line corrosion must be placed in the UE system. The notch must be detected by a minimum of one shear wave beam. The UE gain must be increased until the signal from the notch is maximized at 80 percent of the screen height.

(4) A reference cylinder with a machined notch to represent a longitudinal sidewall crack (LSC) must be placed in the UE system. The notch must be detected by a minimum of two shear wave beams that strike the LSC from opposite directions (e.g. the first shear wave direction is clock wise and second shear wave direction is counter-clock wise). The UE gain must be increased until the signal from the notch is maximized at 80 percent of the screen height.

e. Test Procedures.

(1) During the test, each cylinder must be examined by the standardized (calibrated) UE system using set-up as described in paragraph 7.d. of this exemption.

(2) For each cylinder tested, all 5 scan passes must be performed as they are described in paragraph 7.d.

(3) Alternatively, for retesting only DOT-3A and 3AA specification cylinders, the UE system that is set-up to perform 5 scan passes may perform 3 scan passes that consist of a 100% wall thickness scan, one longitudinal angle beam (descending from the cylinder shoulder down to SBT) and one circumferential (clockwise), angle beam scan when the results do not yield a rejectable flaw. If a cylinder flaw is detected during a test, all 5 scan passes must then be conducted on that cylinder.

(4) A copy of the operating test procedure (as approved and acknowledged in writing by OHMEA) for performing ultrasonic examination of cylinders under the terms of this exemption must be at each facility performing ultrasonic examination. At a minimum, this procedure must include:

(i) A description of the test set-up; test parameters; transducer model number, frequency, and size; transducer assembly used; system standardization procedures and threshold gain used during the test; and other pertinent information.

(ii) Requirement for the equipment standardization to be performed at the end of the test interval (cal-out), after 200 cylinders or four hours, whichever occurs first. This cal-out can be considered the cal-in for the next interval during continuous operation. Cylinders examined during the interval between cal-in and cal-out must be quarantined until an acceptable cal-out has been performed. An acceptable cal-out occurs when the calibration cylinder is examined and all required features are revealed without changing examination settings. If an acceptable cal-out does not occur, if any equipment that affects the UE results are replaced or altered (such as a search unit or coaxial cable etc.) or when a loss of power occurs, all cylinders examined since the last successful calibration must be re-examined. Additionally, standardization of

test equipment shall be performed at the beginning of each work shift, when the cylinder under test has dimensions that exceed the allowable ranges of the reference cylinder, when there is a change of operator(s), if any equipment that affects the UE results are replaced or altered (such as a search unit or coaxial cable etc.) or when a loss of power occurs, and at the end of each work shift.

(5) A copy of the most recent approved operating test procedure must be made available to a DOT representative when requested. Any change to the written procedures or in UE equipment (software or hardware), other than as supplied by the original equipment manufacturer, must be submitted to and approved by AAHMS prior to implementation.

(6) The equipment may not allow testing of a cylinder unless the system has been properly standardized (calibrated).

(7) The rotational speed of a reference cylinder must be such that all simulated defects are adequately detected, measured and recorded.

(8) The rotational speed of the cylinder under UE must not exceed the rotational speed used during the standardization.

(9) The pulse rate must be adjusted to ensure a minimum of 10% over-lapped for each helix.

(10) The area of ultrasonic examination (UE) coverage must be 100% of the cylindrical section. The coverage must extend at least three inches into the sidewall-to-base transition taper.

(11) The external surface of the cylinder to be examined must be free of loose material such as scale and dirt.

f. Acceptance/Rejection Criteria. A cylinder must be rejected based on any of the following:

(1) The wall thickness is less than the design minimum wall thickness for the area described in the standardization section herein, paragraph 7.d.

(2) If any of the flaws such as the isolated pit, circumferential line corrosion or longitudinal

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sidewall crack (LSC) which meet the rejection criteria and produce a signal with an amplitude which crosses the reference threshold set in the standardization section (paragraph 7.d.).

g. Rejected cylinders: When a cylinder is rejected, the retester must stamp a series of X's over the DOT specification number and marked service pressure, or stamp "CONDEMNED" on the shoulder, top head, or neck using a steel stamp, and must notify the cylinder owner, in writing, that the cylinder is rejected and may not be filled with hazardous material for transportation in commerce.

(1) Alternatively, at the direction of the owner, the retester may render the cylinder incapable of holding pressure.

(2) If a condemned cylinder contains hazardous materials and the testing facility does not have the capability of safely removing the hazardous material, the retester must stamp the cylinder "CONDEMNED" and affix conspicuous labels on the cylinder(s) stating: "UE REJECTED DOT-E 14005. RETURNING TO ORIGIN FOR PROPER DISPOSITION". The retester may only offer the condemned cylinders for transportation by a motor vehicle operated by a private carrier to a facility, identified to, and acknowledged in writing with OHMEA, that is capable of safely removing the hazardous material. A current copy of this exemption must accompany each shipment of condemned cylinders transported for the disposal of hazardous material.

h. Marking. Each cylinder passing retests under the provisions of this exemption must be marked as prescribed in accordance with § 180.213. In addition, each cylinder must be marked UE, in characters not less than 1/4 high for a cylinder with a diameter equal to or greater than 4 inches and 1/8" for a cylinder with a diameter less than 4 inches. The marking must be at a location close to the retester's marking.

i. UE Report. A report must be generated for each cylinder that is examined. The UE report must include the following:

- (1) UE equipment, model and serial number
- (2) Transducer specification, size, frequency and manufacturer
- (3) Specification of each standard reference used to perform UE. Standard reference must be identified by serial number or other stamped identification marking.

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- (4) Cylinder serial number and type
- (5) UE technician's name and certification level
- (6) Examination Date
- (7) Location and type of each defect on the cylinder (e.g. longitudinal line corrosion 5 inches from base)
- (8) Dimensions (area, depth and remaining wall thickness) and brief description of each defect
- (9) Acceptance/rejection results
- (10) The UE report must be on file at each test facility, and copies made available to a DOT official when requested.

j. Personnel Qualification: Each person who performs retesting, and evaluates and certifies retest results must meet the following qualification requirements:

(1) Project Manager/Director of Product Technology - is the senior manager of SCI responsible for compliance with DOT regulations including this exemption. Additionally, the project manager must ensure that each operator and senior review technologist maintains the required certifications described herein.

(2) The personnel responsible for performing cylinder retesting under this exemption must be qualified to an appropriate Ultrasonic Testing Certification Level (Level I, II or III) in accordance with the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A depending upon the assigned responsibility as described below:

(i) System startup and calibration must be performed by a Level II operator. A Level II operator may review and certify test results. However, written procedures for accepting/rejecting a cylinder must be provided by the senior review technologist. Based upon written criteria, the Level II Operator may authorize cylinders that pass the retest to be marked in accordance with paragraph 7.h of this exemption. A person with Level I certification may perform a system startup, check calibration, and perform ultrasonic testing under the direct guidance and supervision of a Senior Review Technologist or a Level II Operator, either of whom must be physically present at the test site so as to be able to observe testing conducted under this exemption.

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(ii) Senior Review Technologist (SRT) - is a person who provides written UE procedure, supervisory training, examinations (Level I and II) and technical guidance to operators, and reviews and verifies the retest results. A SRT must have a thorough understanding of the DOT Regulations (49 CFR) pertaining to the requalification and reuse of DOT cylinders that are authorized under both this exemption and ASNT Recommended Practice SNT-TC-1A and must possess either:

- A. A Level III certification from ASNT in Ultrasonic Testing; or,
- B. A Professional Engineer (PE) License with a documented experience for a minimum of 2 years experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the ultrasonic examination technique; or,
- C. A PhD degree in a discipline of Engineering/Physics with documented evidence of experience in Non-Destructive Evaluation (NDE) of pressure vessels or pipelines using the ultrasonic examination technique or research/thesis work and authoring/co-authoring of technical papers published, in recognized technical journals, in the fields of ultrasonic testing methods.
- D. The SRT must prepare and submit the reports required in paragraphs 7.i. and annually verify that the UE program is being operated in accordance with the requirements of this exemption.

The most recent copies of certification (e.g. ASNT Level III, P.E.) must be available for inspection at each requalification facility.

k. OPERATIONAL CONTROLS.

(1) No person may perform inspection and testing of cylinders subject to this exemption unless:

- (i) that person is an employee or agent of SCI and

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has a current copy of this exemption at the location of such inspection and testing;

(ii) that person complies with all the terms and conditions of this exemption; and

(iii) that person is listed on Attachment 1 of this exemption.

(2) The marking of the retester's symbol on the cylinders certifies compliance with all of the terms and conditions of this exemption and the HMR.

(3) Each facility approved by OHMEA to test cylinders under the terms of this exemption must have a resident operator with at least an ASNT Level II Certification in UT.

(4) The UE equipment and operating procedures identified in this exemption are only authorized for use when the approved SRT is available (or alternatively available by telephone or other electronic means) at each facility operating under the exemption.

(5) Notwithstanding the requirements of a RIN Approval for notification of address and personnel changes, any change in Project manager or SRT, with appropriate documentation (i.e. ANST certification), must be submitted to and acknowledged in writing by OHMEA immediately.

8. SPECIAL PROVISIONS:

a. During the initial use of the exemption, the test data, results, and additional technical information deemed pertinent in successful application of the retest procedure must be reported to OHMEA. The purpose of this information is to determine whether certain testing procedures and criteria require modification. In particular, special attention should be paid to evaluating and compiling information on cylinders rejected by the ultrasonic examination procedure. For these rejected cylinders, the defect causing the rejection must be fully characterized and profiled. That is, the specific type of defect should be identified (e.g. pit or general corrosion etc.) and the specific size of the defect should be determined (i.e. length, depth, width, diameter, area, etc.). Cylinder type, size, minimum design wall thickness, age, etc. of the rejected cylinder must be reported. The ultrasonic signal profile should be reported for any defect causing the cylinder

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to be rejected. These results must be summarized and reported to OHMEA on an annual basis. SCI must submit to DOT an evaluation of the effectiveness of the ultrasonic testing program authorized by this exemption as part of any request to renew the exemption submitted in accordance with § 107.109.

b. The total number of cylinders tested and rejected under this exemption must be reported to OHMEA by cylinder class and age. These results must be summarized and reported on an annual basis.

c. Offerors may use the cylinders specified and tested in accordance with the provisions of this exemption for the transportation in commerce of those hazardous materials specified herein, provided no modifications or changes are made to the cylinders, and all terms of this exemption are complied with.

d. Shippers using the cylinders covered by this exemption must comply with the provisions of this exemption, and all other applicable requirements contained in 49 CFR Parts 100-185.

e. Transportation of Division 2.1 (flammable gases) and Division 2.3 (gases which are poisonous by inhalation) are not authorized aboard cargo vessel or aircraft unless specifically authorized in the Hazardous Materials Table (§ 172.101).

f. Transportation of oxygen is only authorized by aircraft when in accordance with § 172.102(c)(2) Special Provision A52 and §§ 175.85(h) and (i).

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, cargo aircraft only and passenger-carrying aircraft, as currently authorized by the regulations for the hazardous materials being transported.

10. MODAL REQUIREMENTS: None, other than as required by the HMR.

11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this exemption and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:

- o All terms and conditions prescribed in this exemption and the Hazardous Materials Regulations, 49 CFR Parts 171-180.

- o Persons operating under the terms of this exemption must comply with the security plan requirement in Subpart I of Part 172 of the HMR, when applicable.
- o Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this exemption must receive training on the requirements and conditions of this exemption in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this exemption, including display of its number, when this exemption has expired or is otherwise no longer in effect.

12. REPORTING REQUIREMENTS: Shipments or operations conducted under this exemption are subject to the Hazardous Materials Incident Reporting requirements specified in 49 CFR §§ 171.15 - Immediate notice of certain hazardous materials incidents, and 171.16 - Detailed hazardous materials incident reports. In addition, the grantee(s) of this exemption must notify the Associate Administrator for Hazardous Materials Safety -- OHMEA, in writing, of any incident involving a package, shipment or operation conducted under terms of this exemption.

Issued in Washington, D.C.:



fe Robert A. McGuire
Associate Administrator for
Hazardous Materials Safety

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(DATE)

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Pipeline and Hazardous Materials Administration, Department of Transportation, Washington, D.C. 20590.
Attention: PHH-31.

Copies of this exemption may be obtained by accessing the Hazardous Materials Safety Homepage at <http://hazmat.dot.gov/exemptions>
Photo reproductions and legible reductions of this exemption are permitted. Any alteration of this exemption is prohibited.

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Only the following locations have been authorized by OHMEA to perform requalification functions described in this exemption. Each authorization is valid only when the associated RIN approval and this exemption remain current. As acknowledged by the list of names and locations below, the grantee of this exemption must notify OHMEA of any change in approval status, company name, address, or new test facility additions within 20 days of that change.

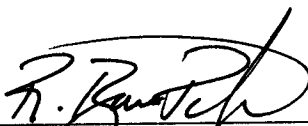
G690 Scientific Cylinder International
Rocky Mountain Region
2835 West Oxford Avenue
Englewood, CO 80110

G680 Scientific Cylinder International
1 Steel Road East
Morrisville, PA 19067

G691 Gateway Cylinder Technologies
21004 Staunton Road
Staunton, IL 62088

G735 Western Sales & Testing
2814 East "P" Avenue
Deer Park, TX 77536

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